WHAT IS CLAIMED IS:

1. A method of communicating with a target vehicle, comprising:

determining a vector ($\vec{v}$) between a reference vehicle and a target vehicle in a global coordinate system;

translating the vector ($\vec{v}$) into a vehicle coordinate system that is referenced to the reference vehicle to produce a translated vector ($\vec{i}_{\vec{v}_{local}}$); and

performing at least one of antenna selection, antenna steering and antenna gain calculation, based on the translated vector ($\vec{i}_{\vec{v}_{local}}$), to communicate with the target vehicle via at least one antenna.

2. The method of claim 1,wherein the at least one antenna comprises a plurality of antennas and wherein performing antenna selection comprises:

selecting an antenna of the plurality of antennas that maximizes a dot product $\vec{i}_{\vec{v}_{local}} \cdot \vec{i}_a$ for each antenna, wherein $\vec{i}_a$ comprises a vector, in the vehicle coordinate system, that points in a direction of a maximum gain of a corresponding antenna of each of the plurality of antennas.

3. The method of claim 1, wherein performing antenna gain calculation comprises:

determining a dot product $\vec{i}_{\vec{v}_{local}} \cdot \vec{i}_a$ and performing a lookup of resulting dot product values to determine a gain, wherein $\vec{i}_a$ comprises a vector, in the vehicle coordinate system, that points in a direction of a maximum gain of the at least one antenna.

4. The method of claim 1, wherein performing antenna gain calculation comprises:

approximating antenna gain as a low-order polynomial function of a dot product $\vec{i}_{\vec{v}_{local}} \cdot \vec{i}_a$, wherein $\vec{i}_a$ comprises a vector, in the vehicle coordinate system, that points in a direction of a maximum gain of the at least one antenna.

5. The method of claim 1, wherein the at least one antenna comprises a phased array antenna, wherein the phased array antenna has its own coordinate unit directions $\vec{i}_1$, $\vec{i}_2$ and $\vec{i}_3$, wherein $\vec{i}_1$ points along a surface of the phased array antenna in one direction, $\vec{i}_2$ points along the phased array antenna surface in an orthogonal direction, and $\vec{i}_3$ is equal to a cross product of $\vec{i}_1$ and $\vec{i}_2$ and is a unit vector normal to the phased array antenna's surface.

6. The method of claim 5, wherein performing antenna steering comprises:

commanding the at least one antenna to present a phase gradient of $2\pi/\lambda\ \vec{i}_1 \cdot \vec{i}_{\vec{v}_{local}}$ in a direction corresponding to the $\vec{i}_1$ unit direction and $2\pi/\lambda\ \vec{i}_2 \cdot \vec{i}_{\vec{v}_{local}}$ in a direction corresponding to the $\vec{i}_2$ unit direction.

7. The method of claim 1, wherein the global coordinate system comprises at least one of a World Geodetic System (WGS) and Military Grid Reference System (MGRS).

8. The method of claim 1, wherein translating the vector ($\vec{v}$) into a vehicle coordinate system comprises:

determining a unit gravity vector ($\vec{i}_{\vec{g}}$) in the vehicle coordinate system.

9. The method of claim 8, wherein translating the vector ($\vec{v}$) into a vehicle coordinate system comprises:

determining a unit magnetic field vector $\vec{i}_{\vec{m}}$ in the vehicle coordinate system.

10. The method of claim 9, wherein translating the vector ($\vec{v}$) into a vehicle coordinate system comprises:

converting the unit magnetic field vector $\vec{i}_{\vec{m}}$ to create a unit vector $\vec{i}_{\vec{N}}$ that is referenced to true north.

11. The method of claim 10, wherein translating the vector ($\vec{v}$) into a vehicle coordinate system comprises:

determining a unit vector ($\vec{i}_{\vec{E}}$) in the east direction.

12. The method of claim 11, wherein translating the vector ($\vec{v}$) into a vehicle coordinate system comprises:

creating a translation matrix $\vec{M}$ using $\vec{i}_{\vec{g}}$, $\vec{i}_{\vec{N}}$ and $\vec{i}_{\vec{E}}$.

13. The method of claim 12, wherein translating the vector ($\vec{v}$) into a vehicle coordinate system comprises:

employing the matrix $\vec{M}$ to translate the vector ($\vec{v}$) into the vehicle coordinate system to produce the translated vector $\vec{i}_{\vec{v}_{local}}$.

14. A reference vehicle, comprising:

a transceiver coupled to at least one antenna; and

processing logic configured to:

determine a line of sight vector between the reference vehicle and a target vehicle in a global coordinate system, wherein the global coordinate system comprises at least one of a World Geodetic System (WGS) and Military Grid Reference System (MGRS),

translate the vector into a vehicle coordinate system that is referenced to the reference vehicle to produce a translated vector, and

perform at least one of antenna selection, antenna steering and antenna gain calculation, based on the translated vector, to communicate with the target vehicle via the at least one antenna.

15. A computer-readable medium containing instructions for controlling at least one processor to perform a method of communicating with a target vehicle, the method comprising:

determining a vector between a reference vehicle and a target vehicle in a global coordinate system;

translating the vector into a vehicle coordinate system that is referenced to the reference vehicle to produce a translated vector; and

performing at least one of antenna selection, antenna steering and antenna gain calculation, based on the translated vector, to communicate with the target vehicle via at least one antenna.

16. A method of rotating a line of sight vector between a reference vehicle and a target vehicle from a first coordinate system to a second coordinate system, comprising:

determining a line of sight vector between the reference vehicle and the target vehicle in a first coordinate system;

determining a local gravity vector at the reference vehicle;

determining a local magnetic field vector at the reference vehicle; and

rotating the line of sight vector into a second coordinate system using the determined local gravity vector and the local magnetic field vector.

17. The method of claim 16, wherein the second coordinate system comprises a vehicle coordinate system referenced to the reference vehicle.

18. The method of claim 16, wherein the first coordinate system comprises a global coordinate system.

19. The method of claim 18, wherein the global coordinate system comprises a Military Grid Reference System (MGRS).

20. The method of claim 16, wherein the local gravity vector is determined using an acceleration sensor.

21. The method of claim 20, wherein the acceleration sensor comprises a three-axis strap-down accelerometer.

22. The method of claim 16, wherein the local magnetic field vector is determined using a magnetic field sensor.

23. The method of claim 22, wherein the magnetic field sensor comprises a three-axis strap-down magnetometer.

24. The method of claim 16, wherein rotating the line of sight vector into a second coordinate system comprises:

creating a rotation matrix using the determined local gravity vector and the local magnetic field vector.

25. The method of claim 24, wherein rotating the line of sight vector into a second coordinate system further comprises:

rotating the line of sight vector using the rotation matrix.

26. A reference vehicle, comprising:

an acceleration sensor;

a magnetic sensor; and

processing logic configured to:

determine a line of sight vector between the reference vehicle and a target vehicle in a global coordinate system,

determine a local gravity vector at the reference vehicle using data from the acceleration sensor,

determine a local magnetic field vector at the reference vehicle using data from the magnetic sensor, and

rotate the light of sight vector into a vehicle coordinate system referenced to the reference vehicle using the determined local gravity vector and the local magnetic field vector.

27. A computer-readable medium containing instructions for controlling at least one processor to perform a method of rotating a line of sight vector between a reference vehicle and a target vehicle from a global coordinate system to a local vehicle coordinate system, the method comprising:

determining a line of sight vector between the reference vehicle and the target vehicle in a global coordinate system, wherein the global coordinate system comprises at least one of a World Geodetic System (WGS) and a Military Grid Reference System (MGRS);

determining a local gravity vector at the reference vehicle;

determining a local magnetic field vector at the reference vehicle; and

rotating the light of sight vector into a local vehicle coordinate system using the determined local gravity vector and the local magnetic field vector.

28. A method of rotating a vector between a reference vehicle and a target vehicle from a global coordinate system to a vehicle coordinate system, comprising:

determining a first vector between the reference vehicle and the target vehicle in the global coordinate system;

determining a second vector, in the vehicle coordinate system, that is parallel to gravity, wherein the vehicle coordinate system is referenced to the reference vehicle;

determining a third vector, in the vehicle coordinate system, that points to true north; and

rotating the first vector from the global coordinate system to the vehicle coordinate system using the second and third vectors.

29. The method of claim 28, wherein the global coordinate system comprises at least one of World Geodetic System (WGS) and Military Grid Reference System (MGRS).

30. The method of claim 28, wherein determining the second vector comprises:

using data, at the reference vehicle, from a three-axis strap-down accelerometer.

31. The method of claim 28, wherein determining the third vector comprises:

using data, at the reference vehicle, from a three-axis strap-down magnetometer.

32. The method of claim 28, wherein the vehicle coordinate system comprises a right-handed coordinate system with an x axis pointed in the vehicle forward direction, a y axis pointed to the right of the vehicle's forward direction, and a z axis pointed downward from the vehicle.

33. The method of claim 28, wherein the first vector comprises a line of sight vector between the reference vehicle and the target vehicle.

34. The method of claim 28, wherein the rotating further comprises:

using vector differences, dot products, cross products and vector normalizations to rotate the first vector from the global coordinate system to the vehicle coordinate system.

35. A first vehicle, comprising:

an acceleration sensor;

a magnetic sensor; and

processing logic configured to:

determine a first vector between the first vehicle and a second vehicle in a global coordinate system,

determine a second vector, in a vehicle coordinate system, that is parallel to gravity using data from the acceleration sensor, wherein the vehicle coordinate system is referenced to the first vehicle,

determine a third vector, in the vehicle coordinate system, that points to true north using data from the magnetic sensor, and

employ vector algebra and the second and third vectors to rotate the first vector from the global coordinate system to the vehicle coordinate system.

36. A computer-readable medium containing instructions for controlling at least one processor to perform a method of rotating a vector between a reference vehicle and a target vehicle from a global coordinate system to a vehicle coordinate system, the method comprising:

determining a first vector between the reference vehicle and the target vehicle in the global coordinate system;

determining a second vector, in the vehicle coordinate system, that is parallel to gravity, wherein the vehicle coordinate system is referenced to the reference vehicle;

determining a third vector, in the vehicle coordinate system, that points to true north; and

using vector algebra and the second and third vectors to rotate the first vector from the global coordinate system to the vehicle coordinate system.

37. A system for communicating with a target vehicle, comprising:

means for determining a vector between a reference vehicle and a target vehicle in a global coordinate system;

means for translating the vector into a vehicle coordinate system that is referenced to the reference vehicle to produce a translated vector; and

means for performing at least one of antenna selection, antenna steering and antenna gain calculation, based on the translated vector, to communicate with the target vehicle via at least one antenna.

38. A data structure encoded on a computer-readable medium, comprising:

first data indicating a line of sight vector between a reference vehicle and a target vehicle in a world coordinate system;

second data indicating a gravity vector corresponding to gravity experienced locally at the reference vehicle;

third data indicating a magnetic field vector in a vehicle coordinate system corresponding to a magnetic field experienced locally at the reference vehicle; and

fourth data indicating a rotation matrix constructed from at least the gravity vector and the magnetic field vector, wherein the rotation matrix rotates the line of sight vector from the world coordinate system to the vehicle coordinate system.

39. The data structure of claim 38, further comprising:

fifth data indicating a direction vector in a vehicle coordinate system corresponding to an eastward direction from the reference vehicle.

40. The data structure of claim 39, wherein the rotation matrix is constructed from at least the gravity vector, the magnetic field vector and the direction vector.